tion. In this small book he now gives a connected statement of all his work.

The phenomena attending the passage of electricity through gases are in many cases very complex, but it has certainly been evident of late years that the fog which has covered the field of exploration is beginning to lift. Here and there we are able to see clearly for a little way and to grasp the relations of various points to one another. The simple and satisfactory theory of ionisation by collision, which Prof. Townsend has worked out, is an instance of this improvement. He shows in the first chapter of his book how electrons set free by the action of ultraviolet light or other agents from one wall of an ionisation chamber grow in number as they are guided across the chamber by a sufficient electric force. Collisions with gas molecules add fresh electrons to the stream, and when the force is not too great the number which eventually reach the opposite wall is an exponential function of the width of the chamber. He bases his explanation on the assumptions that (1) an electron must acquire a certain velocity before it can ionise a gas molecule by colliding with it; (2) a successful collision adds one, and only one, electron to the stream; (3) an electron after a collision, successful or not, has lost all the energy it previously possessed, and starts its career afresh These assumptions can hardly be quite accurate, and the remarkable agreement between the calculated and the experimental results seems almost more than there is any right to expect. It is quite a satisfaction to find that the agreement does not hold in extreme cases, and that the failure is, as the author points out, in the right sense. The third assumption is certainly not always true; Prof. Townsend has himself shown, in later papers not discussed in this book, that an electron can acquire considerable energy in an electric field when moving through a very dry gas; in other words, that the electron does not then give up all its energy at each collision. Again, it is interesting to find that electrons are not to be supposed to be incorporated with the atoms with which they collide; or at least that it has been found possible to ignore such an effect. If the idea is a correct one, it seems unlikely that β-rays can ever be incorporated with atoms with which they collide. Thus the undoubted success of Prof. Townsend's theory opens up further questions of great interest.

In the second chapter it is shown that the positive ions must acquire far more energy than the negative before they can ionise. It is only when the electric force is very great that the influence of the positive ion is perceptible. When, however, the force reaches a certain value the combined action of the positives and the negatives is sufficient to multiply a small initial ionisation indefinitely, and there is a "discharge." The "sparking potential" can be calculated from the ionising coefficients of positives and negatives, as previously found by experiment, and here again there is an excellent agreement between calculation and actual test. A careful explanation is also given of the difference between the sparking potential and the potential necessary to maintain a discharge once started.

The argument of the book is generally quite clear, but there are occasional obscurities. On p. 23, for example, the statement is confused, though essentially accurate of course. "The element *dy* of these paths' is not a proper phrase.

The book is a welcome record of very useful and interesting work.

TWO PHOTOGRAPHIC ANNUALS.

(1) *Penrose's Pictorial Annual. The Process Year Book.* Edited by W. Gamble. Vol. xvi., 1910–11. Pp. x+192. (London: A. W. Penrose and Co., Ltd., n.d.) Price 5*s.* net.

(2) *The British Journal Photographic Almanac,* 1911. Jubilee issue. Edited by George E. Brown. Pp. 1348. (London: Henry Greenwood and Co., n.d.) Price 1*s.* net; cloth, 1*s.* 6*d.* net.

(1) "THE Process Year Book" has for its object the display of specimens of work done by each of the many and various processes of reproduction. Care is taken that each process is represented by a sample obtained with the maximum of efficiency of that process. The volume thus gives the reader an idea of the standard of the workmanship of to-day attained in each case, and also a comparison between the different kinds of results that can be secured.

There is no doubt that many of the processes of reproduction of to-day are really very fine, and a glance through these pages will probably make the reader think that it seems scarcely possible to produce better work. Yet those who are closely associated with the subject, and they are the people who know the true failings, take a somewhat pessimistic view. Thus the editor in last year's annual was of the opinion that the beautiful processes were on the downward grade, and in this volume he states "it cannot be said that the situation is much changed." The race for speed and large output, coupled with no time or desire to experiment, are among the reasons he gives for this halt, or rather retrograde movement.

Nevertheless the volume before us demonstrates that a very high stage of efficiency has already been reached, and it is possible that because such rapid progress in advancement as previously made is not maintained now, this pessimistic view is held.

The amount and quality of the work embodied in this volume is a credit, not only to the editor, Mr. William Gamble, but to the publishers, Messrs. Percy Lund Humphries and Co., Ltd., and the proprietors, Messrs. A. W. Penrose and Co., Ltd. A large number of brief but interesting chatty articles on various branches of the subject are interspaced among the large number of illustrations, and the variety and high standard of the latter are to be highly commended.

Every trouble has been taken to give credit to those who have contributed to the volume, and it may be said that this issue even excels the very excellent volumes which have been noticed before in these columns.

Not only will the book be of high interest to all

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acquainted with reproduction processes, but it should be consulted by those who wish to gain an idea of the many methods available. As a picture book alone the volume is cheap at the price of 5*s*.

(2) This very serviceable publication celebrates its jubilee in the present year. This series of almanacs commenced its life as a wall or sheet calendar, and appeared as a supplement to the *British Journal of Photography* in the year 1860. The current volume is decidedly bulky, and weighs 2·75 lb. Appropriately, it passes in review its past history, and contains a number of portraits of editors and publishers, past and present.

Our photographic readers are all familiar with the general nature of the contents of recent issues, so that it is not necessary to recapitulate these. The epitome of progress, contributed by the editor, is a conspicuous feature as usual, and gives a very useful set of classified abstracts of papers, communications, and articles describing the progress made in technical photography, which have appeared in the British and foreign Press during the twelve months ending October 20, 1910. This alone occupies about 140 pages. Another subject treated, most helpful to those who cannot make themselves acquainted with it first hand, is that which deals with recent novel introductions in photographic apparatus; the eighty-six pages devoted to this are deserving of close attention. The formulæ for photographic processes, covering sixty-seven pages, and the instructions for the use of commercial photographic materials, occupying sixty-five pages, are valuable features to have brought together under one cover. The various tables—chemical, exposure, optical, &c.—and the directory of photographic bodies and societies, all of which are brought well up-to-date, seem to show the mass of useful material embodied in this almanac.

No mention has yet been made of the useful and well-indexed advertisements, which take up nearly two-thirds of the 1348 pages, that compose the volume. These in themselves are very handy for reference. The jubilee number is thus a fitting volume for the occasion, and should, as usual, be in every photographic studio or laboratory.

GEOLOGY AND LANDSCAPE.

Geologische Charakterbilder. Edited by Prof. Dr. H. Stille. Heft ii., Grosse erratische Blöcke im norddeutschen Flachlande. By F. Wahnschaffe. Pp. v+6 plates. Price 3.60 marks. Heft iii., Das Karstphänomen. By A. Grund. Pp. iii+6 plates. (Berlin: Gebrüder Borntraeger, 1910.) Price 4.80 marks.

THE object of these "Charakterbilder" is to provide geologists with a series of illustrations of natural phenomena, which shall be accurate and typical. The authors are selected for special knowledge, and supply several pages of text, printed on sheets of the same size as the plates. The plates, however, are loose, and can be used in the work of small classes, or can be framed for laboratories.

Herr A. Grund deals with the features of the karstlands, and surely a grey instead of a brown tint would have done more justice to the pictures that he has brought together. Except for welcome patches of *terra rossa* round the dolinas, sometimes perhaps turned up newly by the plough, the impression of the karst is eminently white or grey. A few dark trees, themselves almost colourless, break or serve to emphasise the monotony of the slopes. The author aptly compares the dolinas to the valleys of normal areas; they are the channels that lead off the water in a permeable land. The character of a plateau is, moreover, preserved without marked local dissection, in a district where there can be no considerable surface-streams. A peneplane, once established, long remains a peneplane. An interesting discussion is given in connection with plate ii., as to why the limestone or karst areas of higher latitudes, as in Moravia or Champagne, are covered with vegetation, in opposition to those of the Mediterranean region. The chief factor is held to be weathering by frost, which soon cumbers the surface with blocks that promote a soil. Signs of mechanical weathering are almost absent in the barren karstlands. A typical polje is shown from Herzegovina in plate vi., with its alluvial floor contrasting sharply with the desolate limestone hills. In this case the form of the basin is attributed, as in many Bosnian examples, to the deformation of a valley-floor by earth-movements.

Herr Wahnschaffe had a simpler task in describing, in the previous part, a number of large erratics found on the North German plain. The greatest of these, a mass of garnet-mica-gneiss, occurs in a churchyard at Gross-Tychow in Hinterpommern, and measures, above ground, 3·74 m. in height, 15·90 m. in length, and 11·25 m. in breadth. The thick-set fir-woods that surround most of these wanderers from Scandinavia form "Charakterbilder" in themselves. The author provides a clear, brief essay on the history of the theory of glacial transport, beginning with Playfair in 1802.

G. A. J. C.

FOSSIL REMAINS OF MAN.

Der Stand unserer Kenntnisse vom fossilen Menschen. By Prof. W. Branca. Pp. viii+112. (Leipzig: Veit and Co., 1910.) Price 2.50 marks.

WITHIN the last few years there has been a marked recrudescence of interest in the study of the fossil remains of man, and the stream of literature relating to the subject has suddenly become so voluminous that the torrent threatens to overwhelm those readers who cannot devote their whole time to its perusal. In these circumstances any attempt to summarise and criticise this recent work is likely to meet with a hearty welcome, even though, as the author of this work frankly admits, it is far from complete.

Like the compiler of an analogous report on the same subject in this country (Sollas, presidential address to the Geological Society, 1910), the author of the book under review is a geologist, and as such he deals in a critical spirit with the determination of the age of the remains of diluvial man, insisting upon the need for placing chief reliance upon stratigraphic evidence, secondarily on that afforded by associated

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